

**Three New Species of Collembola from North-east India
(Collembola: Arthropleona: Hypogastruridae and Entomobryidae)**

R. K. BHATTACHARJEE

Department of Zoology, St. Anthony's College, Shillong, Meghalaya, India, 793001.

Collection of leaf litter along with decaying pine seeds and Arenga trees produced a number of specimens representing a new species of *Hypogastrura*. Collection with the aspirator and brush method under moss and fine grains of sand yielded two new species belonging to the genera *Cyphoderus* and *Troglopedetes*.

All these collections were made in the vicinity of Shillong, Meghalaya, N.E. India by the author: temp. 3.9°C (winter) to 23.3°C (summer) and average rainfall 241.5 cm. Altitude 1496 m el. to 1960.78 m el., 25°34'N, 91°56'E.

The system of nomenclature used for head and trunk chaetotaxy is from Yosii (1960, 1966a and 1971) and Salmon (1970). Morphological abbreviations used in this paper are as Ant. I, Th. I, Abd. I for 1st antennal segment, 1st thoracic segment, 1st abdominal segment, a₁, m₁ and p₁ for 1st anterior, 1st median and 1st posterior body setae, V₁ and V₂ for setae on vertex of head, S.S. for sensory seta and PAO for post-antennal organ.

The holotypes of the three new species will be deposited in the Zoological Survey of India (Z.S.I.), Calcutta, West Bengal, India and the paratypes will be retained by the author.

FAMILY HYPOGASTRURIDAE

Hypogastrura prabhooii Bhattacharjee, NEW SPECIES

(Plates I and II, Figs. 1–18)

Habitus typical of genus (Fig. 1); length excluding antennae and furca, up to 0.72 mm. Coloration—dorsally bluish black on all segments of the body, head, antennae and eye field. Dark, blue-black longitudinal bands extend from abdomen anteriorly and concentrate in the "area verticalis" on the head. These enclose a light orange pigmented area on mid dorsal line of the Abd. II and III. Ventral tube, tenaculum and furca up to mucronal base with little pigmentation. Setation—head and body covered with small-sized, simple setae, which are not much differentiated. Setal covering of antennae, legs and anogenital segment slightly longer. Integument—coarse and fine granules present on body and head. Dorsal side of den and claw bases finely granular. Abdomen V median area not well defined and with a few, large skin granules.

Antennal ratio—15:20:22:32. Head/antenna—1:1. Sense organs of Ant. III with 2 small rods in a faint groove guarded by 2 sensory setae (Fig. 2). Ant. IV with a single subapical bulb in a pit and with 7–8 well developed, stout sensory rods (Fig. 2). Ant. I without 'P' seta. Antennae ventrally with some small setae. No eversible sac evident between Ant. III and IV. Labrum with 4/5,5,4 setae and labral margin with 4 round, subequal tubercles (Fig. 3). Mandible apically with

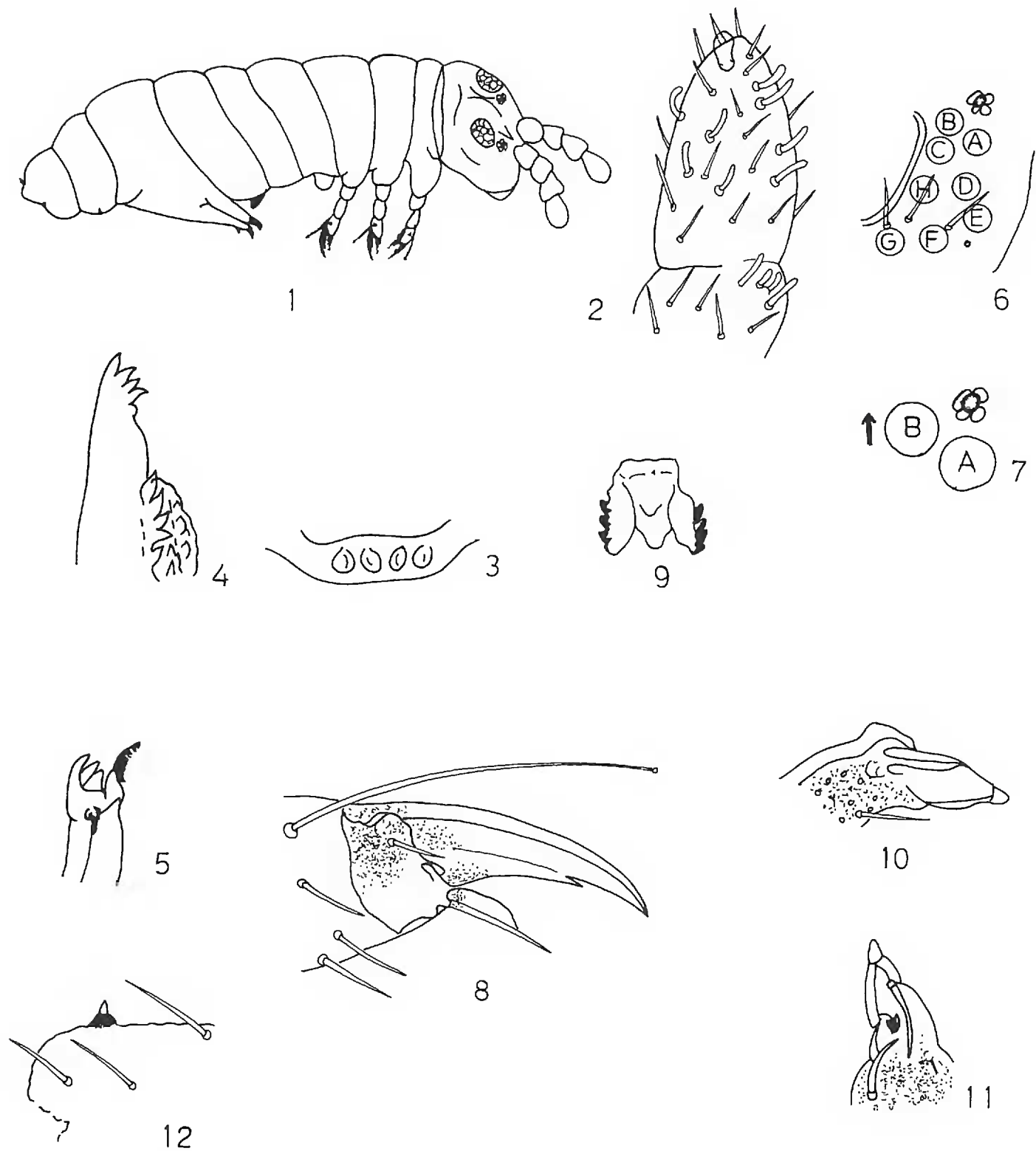


Plate I. *Hypogastrura (s. str.) prabhooii*, n. sp. (Figs. 1-12). Fig. 1. Habitus (clothing and coloration not shown). Fig. 2. Ant. III (distal portion) and Ant. IV with sense rods and subapical bulb. Fig. 3. Labral margin. Fig. 4. Apex of mandible. Fig. 5. Head of maxilla. Fig. 6. Rt. eye and PAO. Fig. 7. Anterior ocelli and PAO. Fig. 8. Metathoracic claw. Fig. 9. Tenaculum. Fig. 10. Mucro (dorsal). Fig. 11. Mucro of another ex. Fig. 12. Posterior part of abdomen with anal papilla and anal spine.

1 + 3 + 1 = 5 teeth, the last slightly smaller and tending to be a round bump. Apical tooth slightly broad and bent inward (Fig. 4). Molar area well developed. Apex of maxilla with 3 apical teeth and one fringed lamella in a finger-like process (Fig. 5).

Ocelli 8 + 8, all subequal (Fig. 6). PAO composed to 4 subequal elements (of which the anterior one is slightly elongated) around a central boss. PAO slightly smaller in diameter than anterior ocellus (Fig. 7). Accessory tubercles absent. Legs (Fig. 8) with unguis lacking lateral teeth but with a fine inner tooth about $\frac{2}{3}$ down from base of claw. Unguiculus almost half as long as unguis, setaceous, with broad

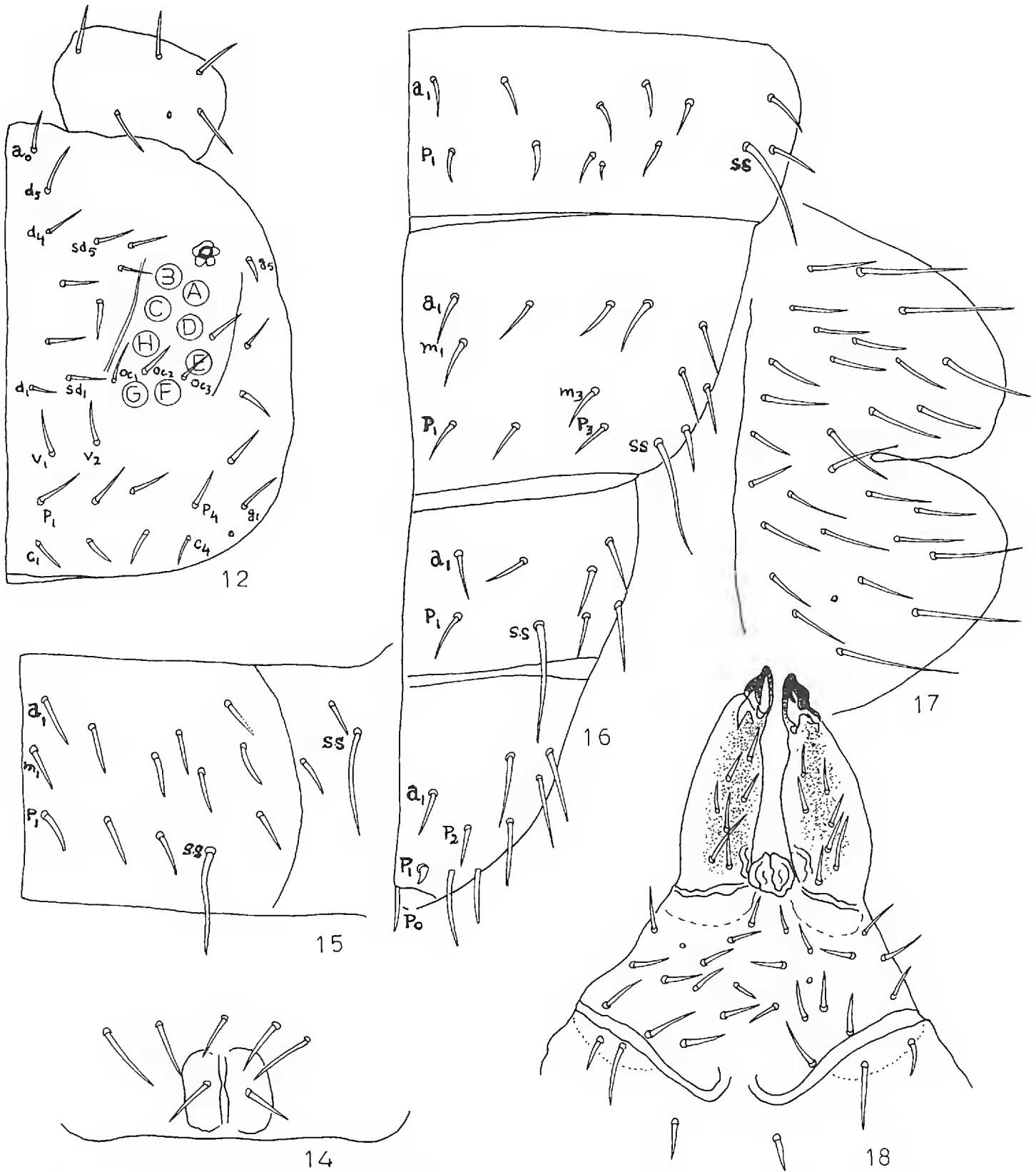


Plate II. *Hypogastrura (s. str.) prabhooii*, n. sp. (Figs. 13–18). Fig. 13. Cephalic chaetotaxy (half portion). Fig. 14. ♂ Genital slit. Fig. 15. Trunk chaetotaxy (Th. II). Fig. 16. Trunk chaetotaxy (Abd. III–VI). Fig. 17. Setae in anal segment (ventral). Fig. 18. Den and mucro (dorsal).

inner lamella. Tenent hair 1,1,1, apically blunt, slightly longer than unguis. Ventral tube anteriorly with 4 + 4 setae. Tenaculum with 4 barbs in rami (Fig. 9). Furcula small, well developed, reaching posterior border of Abd. II. Furcal ratio, man : den : mucro—20:14:4. Manubrium with ca. 26 setae dorsally (Fig. 18). Den with 7 setae dorsally, basal seta (2) longest (Fig. 18). Mucro small, spoon-shaped, apically rounded with inner side thickened and a fine but clear outer lamella (Figs. 10, 11). Anal spines straight and small, placed slightly anteriorly (Fig. 12). Anal papillae separated from each other at base by about 2 granules. Anal spine : anal papilla : mucro = 1:1:3. *Chaetotaxy*—*Head*—no cephalic spines, a_0 present, v_1

and v_2 subequal (Fig. 13). *Body* (Figs. 15, 16) with small, simple, smooth and subequal setae except S.S. and not differentiated. Many setae present around anal aperture (Fig. 17). Setae around genital slit not differentiated (Fig. 14). Thorax II and III with p_4 "sense seta" and m_2 absent. Abd. I–III with 2 rows of setae and in all specimens examined show a quartet of setae in specific arrangement, p_3 may be absent sometimes, p_1 and p_2 subequal, p_5 is S.S. Abd. IV with 3 rows of setae, p_4 is S.S., p_1 and p_2 subequal. On Abd. V p_2 is S.S., Abd. VI with slightly longer setae and p_0 present.

Comparison. — This new species resembles *Hypogastrura* (s. str.) *nepalica* Yosii, 1966a from Maedane Karka, Nepal, in having the ventral tube with 4 + 4 setae, anteriorly placed anal spines and man dorsally with ca. 26 setae. It differs from the *H. nepalica* in possessing a single apical bulb of Ant. IV, labral margin bearing 4 subequal tubercles and S.S. in Abd. IV/V being p_4 and p_2 respectively.

Hypogastrura (s. str.) *prabhooii*, n. sp. is similar to *H.* (s. str.) *himalayana*, Yosii, 1971, Khumbu Himal in having 1, 1, 1 tenent hairs, but differs in the number of PAO elements, by the setae of the ventral tube, absence of paired lateral teeth of the unguis and by having different mucro and 3 rows of setae in Abd. IV.

In color pattern it resembles the endemic species *H. reticulata* (Börner, 1909; Yosii, 1960) of Japan, but the presence of m_3 in Th. III, the separated anal papillae, the spoon-shaped mucro and man with more setae will separate the new species easily.

The new species differs from *H. copiosa* (Folsom, 1916) in having 2 + 2 setae in "area verticalis," Abd. I–III with 2 rows of setae and S.S. in Abd. IV being p_4 .

Comments. — According to R. Yosii, *H. reticulata* is endemic to Japan. Dr. P. F. Bellinger of California State University in a personal letter suggests that this species might be included in the subdivision or group "*Packardi*" of *Hypogastrura* (s. str.), tentatively modified after Yosii by Dr. K. Christiansen and Dr. P. F. Bellinger.

This new species is most respectfully dedicated to Dr. N. R. Prabhuo, Reader in Zoology, Kerala University, a leading Collembolan Taxonomist of India.

Material examined. — *Holotype*: India, Meghalaya, Shillong Peak, 1960.78 m el., collected from rotting pine seeds, 4 February 1975, coll. R. K. Bhattacharjee.

Paratypes: 18, India, Meghalaya, Shillong, Botanical Garden, 1496.00 m el., pine seeds and leaf litter, 9 September 1974; 11, India, Meghalaya, Shillong, Botanical Garden, rotting seeds of pine and rotten Arenga trees, 10 October 1974; 8, India, Meghalaya, Shillong, Shillong Peak, 1960.78 m el., rotting pine seeds, 23 January 1975; 15, from same locality on 4 November 1975. All paratypes collected by R. K. Bhattacharjee.

FAMILY ENTOMOBRYIDAE

Cyphoderus sarojinii Bhattacharjee, NEW SPECIES

(Plate III, Figs. 1–9)

Habitus typical of the genus (Fig. 9). Body length—1.1 mm. Totally white in preserved condition. Ant./head = 5:3. Antennal ratio = 13/34/23/50. Antennae not annulated. Ant. IV without apical bulb; sensory setae numerous, slender and slightly curving and scattered among the ciliated setae. Mandible normal, labrum

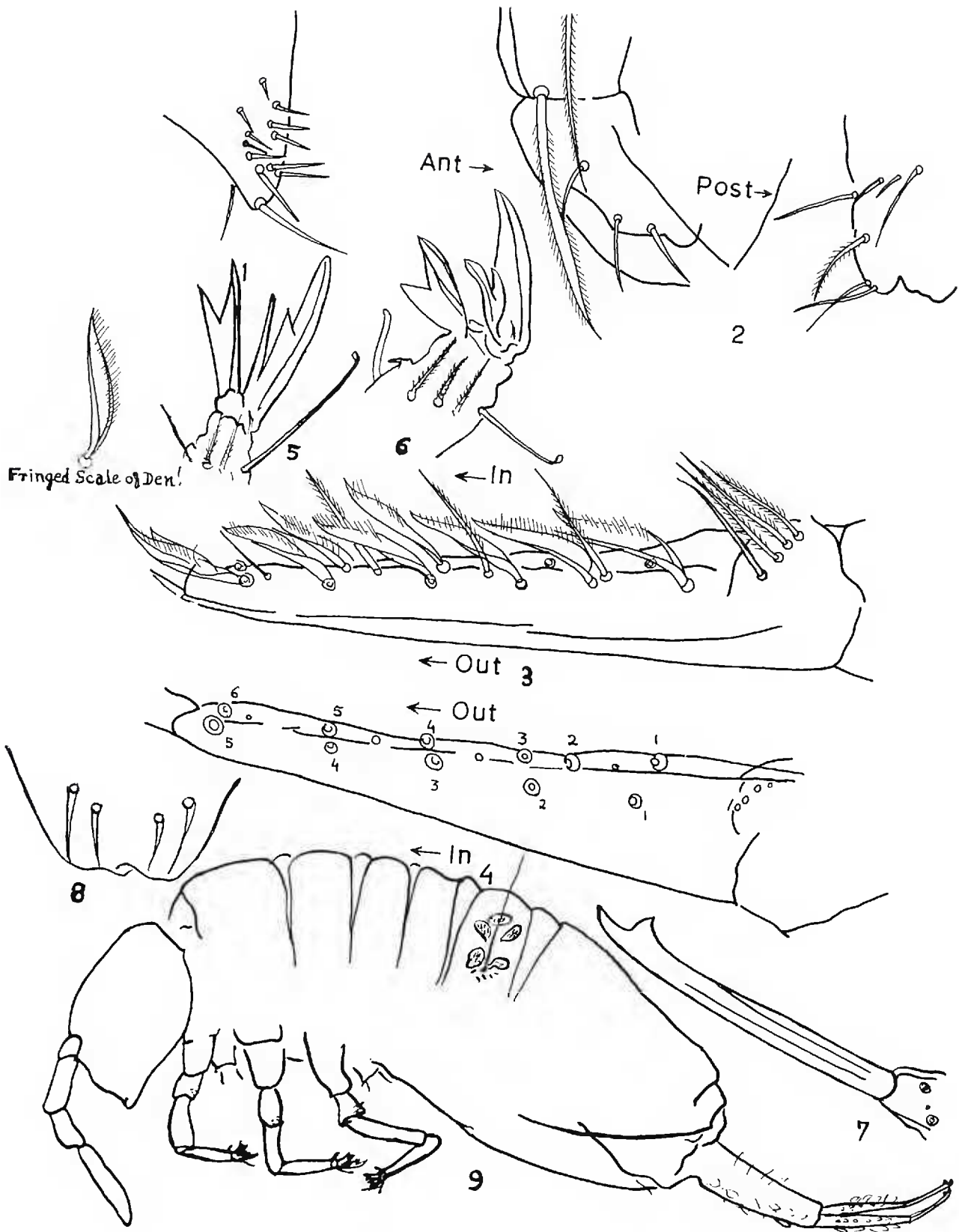


Plate III. *Cyphoderus sarojinii*, n. sp. (Figs. 1-9). Fig. 1. Trochanteral organ. Fig. 2. Ventral tube (anterior and posterior face). Figs. 3, 4. Distribution of fringed scales and feathery setae in den (dorsal). Fig. 5. Mid claw. Fig. 6. Hind claw. Fig. 7. Mucro (dorso-lateral). Fig. 8. Labral margin. Fig. 9. Habitus.

with 4/5,5,4 setae, pre-labral setae smooth (Fig. 8). Labral margin without tubercles or granules and distal smooth portion not intruded, but with a narrow groove in middle. Outermost setae on either side in middle row of labrum slightly thinner than other setae. Labial triangle with 4 smooth setae. Eyes and eye pigment absent. Abd. III/IV = 1/4, Th. II/III = 11/7.

Unguis (Figs. 5, 6) stout with 2 unequal, proximal inner teeth, the anterior one of which is thick and spiny. Posterior tooth of this pair not sharply marked and almost ridge-like. Tenent hair 1,1,1 curved at tip, subequal to unguiculus in length. No inner or outer distal teeth present on unguis. Unguiculus lanceolate with a

broad outer tooth. Lasiotrichia filiform, 2,3,2 on Abd. II–IV and associated with some blunt, small, rod-like setae and scales. Trochanteral organ well represented with ca. 12 setae in an “L”-arrangement (Fig. 1). Setae small and plain. Body without large or flexed setae.

Ventral tube elongate with 2 + 2 slender, ciliated setae on anterior face and ca. 7 (=2 + 2,1,1 + 1) slender setae on posterior face (Fig. 2). Lateral flaps with 3 small setae each. Tenaculum with 4 barbs and corpus with one seta. Furcal ratio = 70:49:26. Manubrium ventrally with scales and dorsally with many ciliated setae. Dentes (Figs. 3, 4) with 6 outer and 5 inner subequal fringed scales. Basal lobe of den with 1 smooth and 3 ciliated setae in a transverse row. There are 3 ciliated and 1 almost plain seta dorsally arranged in the middle on a longitudinal line between the outer and inner rows of scaly setae.

Mucro is relatively longer than in other species and with an almost straight apical and a slightly curved ante-apical tooth (Fig. 7). Margins joining ante-apical to base of mucro smooth.

Comparison. — This new species is similar to *Cyphoderus albinus* (Nicolet, 1841, syn. *C. rubiae*. (Baijal '55) = Yosii, 1966b, Kyoto University Expedition to Karakoram and Hindukush 1955) by its bidentate mucro and claw with 2 unequal inner teeth. It differs from *C. albinus* by having broad, apical and comparatively smaller ante-apical teeth of the mucro, by the somewhat broad, posterior, inner tooth on the claw (Gisin, 1960; Nosek, 1962), by not having the median intrusion of the labral margin and by the different number of trochanteral setae.

The new species differs from *Cyphoderus javanus* Börner, 1906 (syn. *C. assimilis*, Yosii, 1966b) in that it lacks the inner distal tooth of the claw and the median intrusion of the smooth area of the labrum. Further, the lateral flaps of the ventral tube have 3 instead of 2 setae each, the basal lobe of den has 1 smooth and 3 instead of 2 ciliated setae and dorsally den has 3 feathery and 1 smooth setae unlike *C. javanus*.

Cyphoderus simulans (Imms, 1912) (syn. *C. assimilis*, Handschin, 1929) differs from this species in having a longer claw with 1 basal and 2 small distal teeth.

Material examined. — *Holotype*: India, Meghalaya, Shillong, Assam Rifles Road from the side of a hill opposite a stream along with loose stones, 31 October 1974, collected by R. K. Bhattacharjee.

Paratypes: 10, India, Meghalaya, Shillong, Dohling House Compound, Hopkinson Road in loose stone chips blocked by rotten logs, 12 October 1983; 5, from same locality and date as *Holotype*. All paratypes collected by R. K. Bhattacharjee.

FAMILY ENTOMOBRYIDAE

Troglopedetes rasendrans Bhattacharjee, NEW SPECIES

(Plate IV, Figs. 1–13)

Body length up to 1.2 mm. Coloration—light pink in life but white in alcohol. Head diagonal/antenna = 3:5. Antennal segments = 7:13:9:21. General shape *Cyphoderus*-like. Ant. I and II with some scales dorsally. All segments hirsute with short ciliated setae. Ant. IV not subdivided and with an apical end bulb (Fig. 2). Sensory setae of Ant. IV are numerous, blunt, short, slightly curved setae scattered almost throughout its length. Mandible normal (Fig. 12). Labrum (Fig.

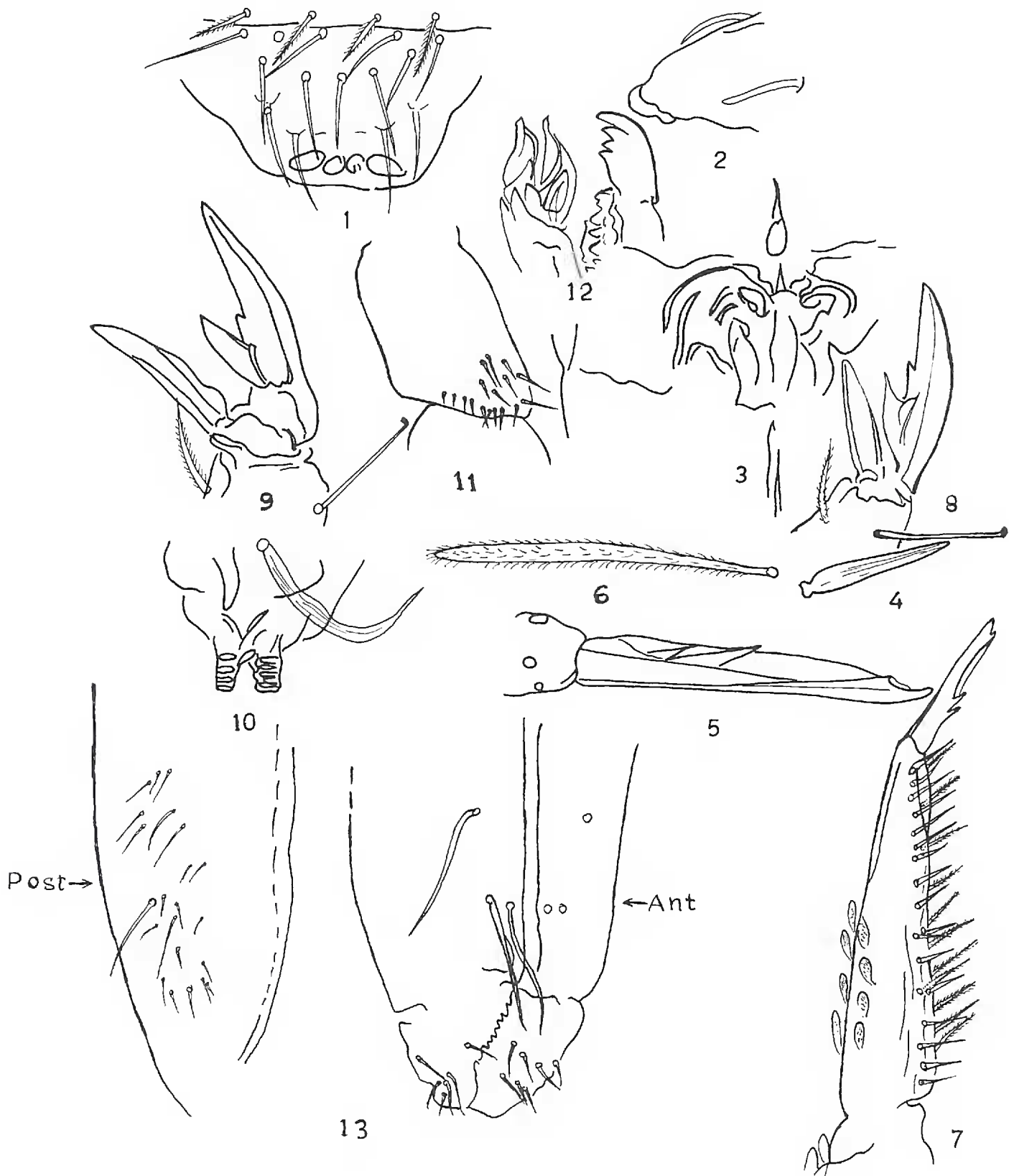


Plate IV. *Troglopedetes rasendrants*, n. sp. (Figs. 1–13). Fig. 1. Labrum. Fig. 2. Apex of Ant. IV and 2-S.S. Fig. 3. Man-den margin (ventral). Fig. 4. Dental spine. Fig. 5. Mucro (dorsal). Fig. 6. Dental ciliated seta. Fig. 7. Den and mucro (dorso-lateral). Fig. 8. Hind claw. Fig. 9. Hind claw of another example. Fig. 10. Tenaculum. Fig. 11. Trochanteral organ. Fig. 12. Apex of maxilla and mandible (different magnification). Fig. 13. Ventral tube posterior, lateral and anterior face.

1) with 4/5,5,4 setae, pre-labral setae lightly ciliated. Labral margin with 2 + 2 unequal tubercles. No median intrusion present. Eyes, eye pigments and postantennal organ absent. Legs without scales. Trochanteral organ consisting of ca. 18 setae of various lengths in a "L" arrangement (Fig. 11).

Ratio of trochanter : femur : tibio-tarsus of hind leg = 11:20:37. Unguis (Figs. 8, 9) with paired, winglike inner basal teeth. A well developed inner tooth is placed above the winged teeth. Unguiculus lanceolate, tenent hair short, 1,1,1, in number and slightly knobbed at apex.

Ventral tube (Fig. 13) anteriorly with 3 + 3 long setae (i.e. 1 + 1, 2 + 2), posterior face with ca. 21 setae of various lengths and lateral flaps with 7 setae each.

Tenaculum with 4 barbs on rami (Fig. 10) corpus with one long seta. Abd. IV is 3.5 times length of Abd. III.

Furcal ratio = 30/19/6, den/3.76 times mucro. Manubrium dorsally with ciliated setae and with scales laterally and ventrally. Manubrium-den margin as in Figure 3. Dentes (Fig. 6) dorsally with ciliated setae and inner (ca. 17) spines (Fig. 4) and outer (ca. 9) strongly ciliated, elongate, spiny setae, distal inner spines slightly larger (Fig. 7). Ventral side of dentes with elongate scales. Mucro long with a blunt apical, a small antepical and one small and one large proximal dorsal teeth on outer margin that connects antepical tooth with mucronal base (Fig. 5). No dental scale-like appendage present.

This species is almost achaetotic having only small and medium length, ciliated setae on the body. Antennae, legs and furca lacking macrochaetae. All body segments, head, Ant. I and II with round, finely hyaline scales. Ventral side of head, manubrium and dentes with elongate ribbed scales. "Setae sensuales" in Abd. II and III are 2 and 3 respectively.

Comparison.—This species differs from *Cyphoderopsis ceylonica* (R. Yosii—1966b—Coll.: of Afghanistan, India and Ceylon) in the number and nature of setae on the posterior face of the ventral tube, the den:mucro ratio, the labral margin and by having less (2 instead of 4) teeth on the proximal dorsal side of the mucro. It differs from *Cyphoderopsis kempi* (G. H. Carpenter—1917—Coll.: Abor expedition) in lacking "dental scale-like appendage," lacking serrations on the proximal dorsal teeth of the mucro and in having double proximal dorsal teeth instead of a single tooth. The new species differs from *Troglopedetes cavernicola* (Delamare, 1944) by the unsubdivided Ant. IV, the absent distal dental scale appendage and lanceolate unguiculus.

In having 2 teeth on the proximal dorsal side of the mucro the new species is similar to *Cyphoderopsis 6-ocellata* (Yosii, 1966b) but *C. 6-ocellata* has 3 + 3 eyes. The present species differs from *Cyphoderopsis gracilis* (Carpenter, 1924) from Siju caves, Garo Hills, in that *C. gracilis* has long antennae, short mucro and toothless unguis.

Comment.—The genus *Troglopedetes* has usually only one row of dental spines and the genus *Cyphoderopsis* has 2 rows of dental spines. According to Salmon (1964) this difference is insufficient to separate the two genera. Dr. R. Yosii holds that these divisions are only provisional and Dr. P. F. Bellinger suggests that the presence of the dental scale-like appendage of *Cyphoderopsis* may justify the separation of *Cyphoderopsis* from *Troglopedetes* (personal communications). Considering the above opinions I have included this new species in *Troglopedetes*.

Material examined.—*Holotype*: India, Meghalaya, Shillong Peak, 1960.78 m el., collected from under thick layer of moss above stones on the side of a hill, 24 October 1974, collected by R. K. Bhattacharjee.

Paratypes: 4, same locality and date as Holotype; 5, India, Meghalaya, Shillong, Boyce Road, collected from stone chips on the side of a hill, 20 October 1974; 4, India, Meghalaya, Shillong, Elephant falls area 1950.00 m el., 24 October 1974; 5, India, Meghalaya, Shillong, Hopkinson Road, Dohling House compound (along with *Cyphoderus sarojinii*, n. sp.) in the stone chips, 12 October 1983; 5, India,

Meghalaya, Shillong, Crinoline falls area, 15 September 1974. All paratypes collected by R. K. Bhattacharjee.

ACKNOWLEDGMENTS

I wish to express my sincere gratitude to Dr. P. F. Bellinger of California State University for his comments and critical analysis of this work. Thanks are also due to Dr. R. Yosii for his letter regarding *H. (s. str.) reticulata* and comments on the genera *Cyphoderopsis* and *Troglopedetes*.

LITERATURE CITED

- Baijal, H. N. 1955. Entomological survey of Himalaya, Part XI—on 5 new spp. of Collembola. Agra Univ. J. Res. (Sci.), 4(2):531–538.
- Carpenter, G. H. 1917. Collembola, Zool. Results of Abor Expedition 1911–1912. Rec. Indian Mus., 8:561–568.
- . 1924. Collembola of the Siju Cave, Garo Hills, Assam. Rec. Ind. Mus., 26:285–289.
- Gisin, H. 1960. Collembolen fauna Europas Museum D'Histoire Naturelle. Geneve, 312 pp.
- Imms, A. D. 1912. On some collembola from India, Burma and Ceylon. Proc. Zool. Soc. London, 1912:80–124.
- Nosek, J. 1962. The Apterygotes from Czechoslovakian Soil III. Collemb. Entomobryidae. Zoologicke listy, Folia Zoological 1962, Vol. XI(XXV), No. 4.
- Salmon, J. T. 1956. On two Hypogastruridae (Collembola) from India. Proc. R. Ent. Soc. Lond. (B) 25 pts., 9–10.
- . 1964. An index to Collembola. Royal Soc. of N.Z., Bulletin No. 7, Vol. I, pp. 1–145, Vol. II, pp. 146–644.
- . 1970. Some new records and new species of Collembola from India. Trans. R. Soc. N.Z., Biol., Sci. Vol. 12, No. 13, pp. 145–152, 44 figs.
- Yosii, R. 1960. Studies on the Collembolan genus *Hypogastrura*. American Midland Nat., 64(2): 257–281.
- . 1966a. Collembola of Himalaya. J. Coll. Arts and Sci. Chiba Univ., 4(4):461–531.
- . 1966b. On some collembola of Afghanistan, India and Ceylon. Res. Kyoto Univ. Sc. Exped. Karakoram, Hindukush, 8:333–405.
- . 1971. Collembola of Khumba Himal. Ergebniss. Forsch. Nepal Himalaya, 4:80–130.